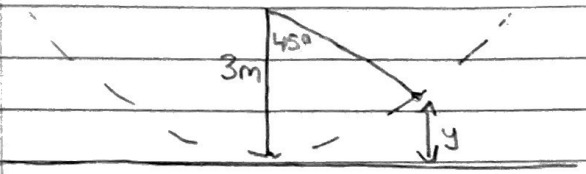
10. Problems
10, 11, 20, 43, 45
10. Conceptual
4, 5
Supplementary Ex:
61

10/15

Taylor Larrechea 10:00-10:50
MTWF
Phys 131

Chapter 10 Problems

10



$E_i = \frac{1}{2}mv^2$

$E_f = mgy$

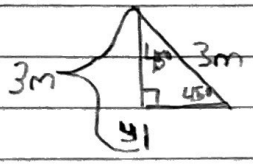
$\frac{1}{2}mv^2 = mgy$

$\frac{1}{2}(20\,kg)v^2 = 20kg(9.8m/s^2)0.88m$

$10kg\,v^2 = 172.48$

$v^2 = 17.248$

$v = 4.15\,m/s$



Y comp

$3\cos 45 = \frac{3\sqrt{2}}{2}$

$y + \frac{3\sqrt{2}}{2}m = 3m$

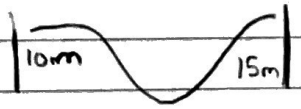
$y = 3m - \frac{3\sqrt{2}}{2}m$

$= 0.88m$

$y = 0.88m$

$V = 4.15\,m/s$

11



$m = 1500\,kg$ $K = \frac{1}{2}mv^2$ $v_0 = 10\,m/s$

$K = 75,000J$

$E_i = \frac{1}{2}mv_i^2 + mgy_i$

$E_f = \frac{1}{2}mv_f^2 + mgy_f$

$\frac{1}{2}mv_i^2 + mgy_i = \frac{1}{2}mv_f^2 + mgy_f$

$75,000 + 1500kg(9.8m/s^2)10m = \frac{1}{2}(1500)kg\,v_f^2 + 1500kg(9.8m/s^2)15m$

$222,000\,J = 750v_f^2 + 220,500J$

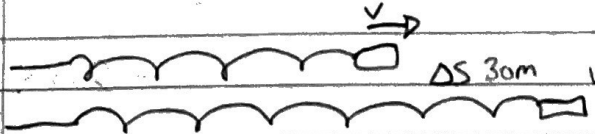
$1500\,J = 750v_f^2$

$2 = v_f^2$

$v_f = 1.4m/s$

$v_f = 1.4\,m/s$

20



$v = 0$ $E_i = \frac{1}{2}mv_i^2$ $E_i = E_f$

$E_f = \frac{1}{2}k(\Delta s)^2$

$m = 15,000\,kg$

$k = 60,000\,N/m$

$\Delta s = 30m$

$\frac{1}{2}mv_i^2 = \frac{1}{2}k(\Delta s)^2$

$\frac{1}{2}(15,000kg)v_i^2 = \frac{1}{2}(60,000\,N/m)30m^2$

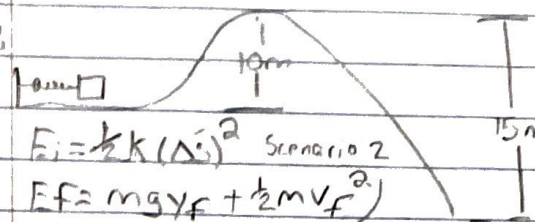
$7,500v_i^2 = 30,000\,N/m \cdot 900m^2$

$v_i^2 = \frac{27,000,000\,N/m(m^2)}{7,500\,kg}$

$v_i = 60\,m/s$

$V_i = 60\,m/s$

43



Scenario 2

$E_i = \frac{1}{2}k(\Delta s)^2$

$E_f = mgy_f + \frac{1}{2}mv_f^2$

Scenario 1

$E_i = \frac{1}{2}k(\Delta s)^2$

$E_f = mgy_f$

$E_i = E_f$

$\frac{1}{2}k(\Delta s)^2 = mgy_f$

$\frac{1}{2}k(2.0m)^2 = 400kg(9.8m/s^2)\cdot 10m$

$\frac{1}{2}k(4.0m^2) = 39{,}200$

$1k(4.0m^2) = 78{,}400$ → $k = 21{,}560\ N/m$

$k = 19{,}600$

$19{,}600 \times 1.1 = 21{,}560\ N/m$

10% increase

$m = 350\ kg$

$y_f = -5m$

$\frac{1}{2}k(\Delta s)^2 = mgy_f + \frac{1}{2}mv_f^2$

$\frac{1}{2}(21{,}560N/m)2.0m^2 = 350kg(9.8m/s^2)(-5m) + \frac{1}{2}(350kg)v_f^2$

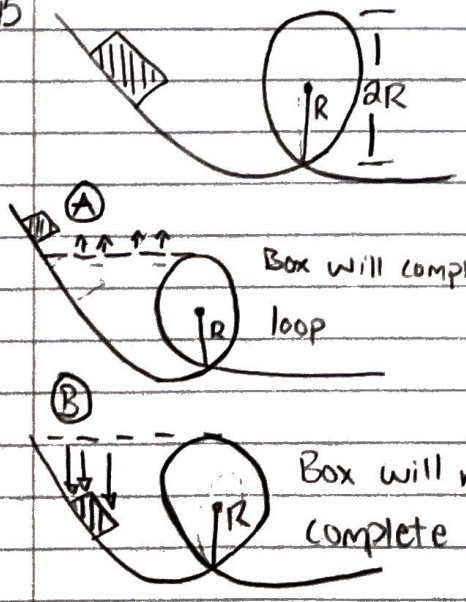
$43{,}120\ J = -17{,}150\ J + 175kg\,v_f^2$

$60{,}270 = 175kg\,v_f^2$

$1722/5 = v_f^2$

$v_f = 18.56\ m/s$ → $18.56\ m/s$

45



The box would have to be dropped at a height greater than 2r For there to be enough kinetic energy left over so the box could actually complete the loop.

exactly how much = 2.5R

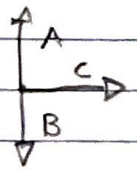
use energy conservation + forces at top

1/3

Total Energy	Potential Energy	Kinetic Energy
A > B	A > B	A > B
	H > 2R	

+1

Chapter 10 Conceptual

4. 

$(V_B = V_A) > V_C$

Velocities of A & B have strictly only y-components where as C has x & y components of velocity. Therefore A & B are ~~equal and~~ greater than C.

Use energy conservation ⇒ velocity same when hitting

0/3

5 a.) K, $\Delta s = 1$ — compressed D

b.) $\Delta s = 1$, K — stretched D

c.) 2K, $\Delta s = 1$ — stretched D

d.) 2K, $\Delta s = 2$ — stretched 2D

$((u_{sp})_D > (u_{sp})_C > (u_{sp})_A = (u_{sp})_B)$

D.) $\frac{1}{2}(2K)(2)^2$ C.) $\frac{1}{2}(2K)(1)^2$ B.) $\frac{1}{2}K(1)^2$ A.) $\frac{1}{2}K(1)^2$

$4K > K > \frac{1}{2}K = \frac{1}{2}K$

61 Sledding

King Zog, with mass 160 kg, and Queen Geraldine, with mass 80 kg, sled down an icy hill. They start from rest at the same point above the bottom of the hill. Ignore friction and air resistance. Which of the following is true regarding their speeds at the bottom of the hill? Explain your answer.

$PE = KE$

$mgh = \frac{1}{2}mv^2$ $\quv^2 = 2gh$

$gh = \frac{1}{2}v^2$ $\quv = \sqrt{2gh}$

velocity is indepent of mass, therefore same speeds.

Both start at same h value

(i) Same speeds.

ii) Geraldine's speed is twice that of Zog.

iii) Geraldine's speed is four times that of Zog.

iv) Zog's speed is larger than Geraldine's speed.

62 Spring bumper

Two walruses (named X and Y), with the same masses, slide along horizontal sheets of ice. Each collides with a horizontal spring mounted to a wall; the springs are identical. Prior to hitting the spring, walrus X moved with speed twice that of walrus Y. The springs compress, bringing each walrus to a stop. Which of the following is true regarding the distances by which the springs compress? Explain your answer.

i) Springs compress by the same distance.

ii) X compresses spring by twice as much Y.

iii) X compresses spring by four times as much Y.

iv) X compresses spring by half as much Y.

v) X compresses spring by a quarter of what Y compresses.